EXHIBIT 1

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION**

NCS MULTISTAGE INC., Plaintiff, v. NINE ENERGY SERVICE, INC., Defendant.	CIVIL ACTION NO. 6:20-CV-00277-ADA **JURY TRIAL DEMANDED**

<u>DECLARATION OF DR. NATHAN MEEHAN</u>

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I. INTRODUCTION

1. My name is Nathan Meehan, Ph.D. I have been retained on behalf of Nine Energy Services, Inc. ("Nine") to provide expert opinions regarding U.S. Patent No. 10,465,445 (the "'445 Patent" or the "Asserted Patent"). Based on my analysis and investigation, I have reached certain conclusions and developed certain opinions on the issues relating to the Asserted Patent that are set forth below. I understand the scope of this declaration is limited to the Court's claim construction proceedings, and, therefore, I confine my opinions regarding the Asserted Patent to issues solely related to the construction and indefiniteness of the claims. This Declaration is based on information currently available to me. I reserve the right to continue my investigation and study, which may include a review of documents and information that has been or may be produced, as well as deposition testimony from depositions for which transcripts are not yet available or that may later be taken in this case.

2. Therefore, I expressly reserve the right to expand or modify my opinions as my investigation and study continues, and to supplement my opinions in response to any additional information that becomes available to me, any matters raised by the plaintiff or opinions provided by its expert(s), or in light of any relevant orders from the Court.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

3. I have provided a copy of my *curriculum vitae* ("CV") with this Declaration. *See* Exhibit 8. I have more than 40 years experience working as a Petroleum Engineer and am a Licensed Professional Engineer in Texas, Oklahoma, Louisiana and Mississippi (testimony only). My experience is based on a forty-four (44) year career working on land, offshore and deep-water drilling rigs in the continental United States and Alaska as well as dozens of foreign countries with their respective customs and practices. I received a B.Sc. in Physics from the Georgia Institute of

Technology; a M.Sc. in Petroleum Engineering from the University of Oklahoma; and a Ph.D. in Petroleum Engineering from Stanford University.

4. In August 2020, I was named an Honorary Member of the Society of Petroleum Engineers ("SPE"). This is SPE's highest honor and it is limited to roughly 0.1% of SPE's total membership. I received the award in the Fall of 2020.

5. My qualifications include: SPE President (2016); SPE Board Member (two 3-year terms); Advisory Board member for World Oil magazine (25 years); Director of JOA Oil & Gas B.V. (2 years); Chairman of the Board of the CMG Reservoir Simulation Foundation (3 years); a Director of the Computer Modelling Group, Ltd. (a publicly traded reservoir simulation software company) (3 years); Director of Pinnacle Technologies, Inc. a technology and service company specializing in surface and subsurface data acquisition and related consulting (3 years); Director of Vanyoganeft Oil Company, Nizhnyvartosk, Russia (this was a 50-50 joint venture with TNK-Nizhnevartovsk and Occidental Petroleum in Western Siberia) (2 years); Director of Pinnacle Technologies, Inc. (a technology and service company specializing in surface and subsurface data acquisition and related consulting) (3 years); Director of the Computer Modelling Group (Calgary) (1992-1997); Appointed member of the Interstate Oil and Gas Compact Commission by Governors George W. Bush and Rick Perry (15 years); Member of the National Petroleum Council (3 years); Member of the University of Texas Petroleum Engineering Advisory Board (6 years); Member of the University of Houston, University of Oklahoma and Penn State Petroleum Engineering Advisory Boards; Member of the Georgia Tech Energy Advisory Board (2-3 years each); member of the Advisory Board of the College of Sciences at the Georgia Institute of Technology; and Member of the Technical Advisory Board of the Horizontal Well Unit of Heriot-Watt University and The Petroleum Science and Technology Institute, Edinburgh, Scotland.

6. I am the author or co-author of three books and approximately 100 journal publications, as shown in the List of Publications at the conclusion of my CV. *See* Exhibit 8. These publications include twelve publications on the specific topic of horizontal well applications. I was co-editor of a book titled **Unconventional Oil and Gas Resources: Exploitation and Development**, published by CRC Press/Taylor & Francis, 2016. This book won the 2017 PROSE Award for best book in Engineering and Technology. https://proseawards.com/winners/2017-award-winners/.

7. I served as an SPE Distinguished lecturer on the topic of "Evaluating the Impact of Horizontal Wells on Production Performance" from 1991 to 1992 giving more than forty lectures in thirteen countries on the topic.

8. I have participated in numerous SPE Forums and Workshops as an attendee, presenter and leader on a variety of topics directly related to well construction of horizontal wells.

9. My areas of expertise include, but are not limited to, well design, construction, operations and supervision (land, offshore, and deepwater); completions including planning and design, perforating, acidizing, hydraulic fracture stimulation, operations and supervision, and recompletions; production including reservoir analysis, design and construction of surface production facilities, pipelines from the production equipment to sales lines; well workovers; well abandonment, both temporary and permanent; safety planning and implementation. Within these areas of expertise, I have worked in a wide range of capacities from well-site supervision to executive management; author; teacher of industry training courses; university professor and research associate; managed and directed joint industry research programs; and providing expert witness services.

10. Other details concerning my background, professional service, and more, are set forth in my CV. *See* Exhibit 8.

11. In forming my opinion expressed in this report, I relied on my knowledge, skill, training, and education and over forty-four (44) years of professional experience in land, offshore and deepwater drilling. With this broad knowledge and experience of oil field tools products and services, I believe that I am qualified to provide an accurate assessment of the technical issues in this case.

12. I am being compensated at an hourly rate of $625.00 for my time spent on this case. My compensation does not depend on the outcome of this case.

III. SUMMARY OF OPINIONS AND MATERIALS CONSIDERED

13. To prepare this declaration, I have reviewed and considered the ’445 Patent and the prosecution history associated with the ’445 Patent. Additionally, I have considered my knowledge and direct relevant experience in the industry at the time of the Asserted Patent’s respective filing date and earliest priority date. I am also aware of information generally available to, and relied upon by, persons of ordinary skill in the art at the relevant time.

14. It is my opinion that the following claim terms would be understood by a person of ordinary skill in the art at the time of the alleged invention, in possession of the specification, claims, and prosecution history (“POSA”) as follows:

Term #	Disputed Claim Term	Understanding of a POSA
1	“internal diameter” (Claims 1, 22, 28, 50)	the diameter of a fluid channel measured perpendicularly from the inner wall of the fluid channel through the center of the casing string, to the opposite inner wall
2	“tubular member” (Claims 1, 22, 28, 50)	an upper tubular member, and a lower tubular member coupled with the upper tubular member
3	“sealing engagement” (Claims 1, 22, 28, 50, 55)	attached or secured to create a fluid-tight seal
4	“the rupture disc is. . . configured to rupture when exposed to a rupturing force greater than the rupture burst pressure”	**Term is Indefinite Under 35 U.S.C. § 112**

Term #	Disputed Claim Term	Understanding of a POSA
	(Claims 1, 22, 29, 56).	**Proposed Alternative** – the rupture disc will rupture when exposed to a rupturing pressure greater than the rupture burst pressure
5	"rupturing force" (Claims 1, 22, 27, 29, 56, 57)	**Term is Indefinite Under 35 U.S.C. § 112** **Proposed Alternative** – rupturing pressure
6	"the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string" (Claims 1, 22, 28, 50)	**Term is Indefinite Under 35 U.S.C. § 112** **Proposed Alternative** – a flat surface of the tubular member where the rupture disc is fastened, affixed, joined, or connected to the tubular member is circular and has a diameter larger than the internal diameter of the casing string, and defines a plane that is parallel to a plane defined by the set of internal diameters at a location in the casing string
7	"specific gravity . . . of the well fluid" (Claims 24, 52)	**Term is Indefinite Under 35 U.S.C. § 112**
8	"disengage the rupture disc from sealing engagement" (Claim 55)	disengage the rupture disc from being attached or secured to create a fluid-tight seal
9	"rupture disc is configured to disengage from sealing engagement when exposed to a pressure greater than a hydraulic pressure in the casing string" (Claims 28, 50)	**Term is Indefinite Under 35 U.S.C. § 112**
Term #	**Agreed Claim Term**	**Understanding of a POSA**
10	"float shoe" (Claims 15 & 43)	a sealing device disposed at the lower end of the casing string
11	"a pressure . . . greater than a hydraulic pressure in the casing string" (Claims 28, 50, 55)	an applied pressure that is greater than the hydrostatic pressure in the casing string
12	"a portion of the sealed chamber is buoyant in the well fluid" (Claim 46)	the density of a portion of the sealed chamber is lower than that of the surrounding wellbore fluid

IV. SUMMARY OF THE LAW

15. I am not an expert in patent law; however, I have been informed that the claims of a patent are judged from the perspective of a POSA. I have been informed that the claims of the Asserted

Patent are interpreted as a POSA would have understood them in the relevant time period (*i.e.*, when the patent application was filed or the priority date of the patent). I have been informed of the relevant law as recounted in this Declaration.

16. I understand that a POSA is a hypothetical person who is presumed to have known the relevant art at the time of the invention. Such a hypothetical person would have the capability of understanding the scientific and engineering principles applicable to the pertinent art of the claimed invention. Factors that may be considered in determining the level of ordinary skill in the art include: (A) the type of problems encountered in the art; (B) prior art solutions to those problems; (C) rapidity with which innovations are made; (D) sophistication of the technology; and (E) educational level of active workers in the field.

17. These legal principles have provided me with the framework for my analysis, and, where applicable, I have relied upon and followed these principles in my analysis. In keeping with the appropriate uses of expert testimony, I have been asked to provide assistance in ensuring that the Court's understanding of technical aspects of the patents-in-suit is consistent with that of a POSA, and in establishing that particular terms in the patents-in-suit have particular meanings.

A. Patent Invalidity

18. I understand that an issued patent is presumed valid. However, I understand that an issued patent may be invalidated in a lawsuit based on clear and convincing evidence that the patent is anticipated under 35 U.S.C. § 102, that it is obvious under 35 U.S.C. § 103, or that the patent fails to comply with the statutory requirements for the specification and claims under 35 U.S.C. § 112.

B. Indefiniteness

19. I understand that 35 U.S.C. § 112(b) requires that the specification "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter" that the inventor

regards as his or her invention. I understand that the requirement of this provision is commonly called the "definiteness" requirement.

20. I understand that definiteness is to be evaluated from the perspective of someone skilled in the relevant art, and that definiteness is measured from the viewpoint of a POSA at the time of the effective filing date of the patent's application.

21. I understand that, in assessing definiteness, claims are to be read in light of the patent's claims, specification, and prosecution history.

22. I understand that the definiteness requirement requires that a patent's claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty. Failing to do so results in the term being indefinite.

23. I understand that, in assessing definiteness resulting from an error in the issued claim, a court can correct an error only if the error is evident from the face of the patent. I also understand that a court will consider whether a correction is subject to reasonable debate based on consideration of the claim language and the specification. I further understand that a court will consider the prosecution history to determine whether it suggests a different interpretation of the claim language.

24. I understand that the purpose of the definiteness requirement is to make sure that the patent claims adequately perform their function of notifying the public of the scope of the patent, and of the patent owner's right to exclude. For example, if a competitor attempting to practice a claimed invention or design around it would be unable to discern the metes and bounds of the invention, the claim may be indefinite.

C. Claim Construction

25. I understand that the claims of a patent define the limits of the patentees' exclusive rights. In order to determine the scope of the claimed invention, courts typically construe (or define) claim

terms. I understand that claim construction begins with a focus on the words of the claims themselves, as they would have been understood by a POSA at the time of invention. I understand that, absent some reason to the contrary, claim terms are generally given their ordinary and customary meaning as would have been understood by a POSA at the time of the invention, and my opinions below are rendered from this perspective.

26. I understand that claims must be construed, however, in light of and consistent with the patent's intrinsic evidence. Intrinsic evidence includes the claims themselves, the written disclosure in the specification, and the patent's prosecution history, including the prior art that was considered by the United States Patent and Trademark Office ("PTO").

27. I understand that the language of the claims help guide the construction of claim terms and the context in which a term is used in the claims can be highly instructive.

28. I understand that the specification of the patent is the best guide to the meaning of a disputed claim term. Embodiments disclosed in the specification help teach and enable those of skill in the art to make and use the invention, and are helpful to understanding the meaning of claim terms. Nevertheless, in most cases, preferred embodiments and examples appearing in the specification should not be read into the claims.

29. In the specification, a patentee may also define his own terms, give a claim term a different meaning than it would otherwise possess, or disclaim or disavow claim scope. A claim term is generally presumed to possess its ordinary meaning. This presumption, however, does not arise when the patentee acts as his own lexicographer by explicitly defining or re-defining a claim term. This presumption can also be overcome by statements, in the specification or prosecution history of the patent, of clear disclaimer or disavowal of a particular claim scope.

30. I understand that the specification may also resolve any ambiguity where the ordinary and customary meaning of a claim term lacks sufficient clarity to permit the scope of the claim to be ascertained from the claim words alone.

31. I understand that the prosecution history is another important source of evidence in the claim construction analysis. The prosecution history is the record of the proceedings before the PTO, including communications between the patentee and the PTO regarding the patent application. I understand that the prosecution history can inform the meaning of the claim language by demonstrating how the patentee and the PTO understood the invention and whether the patentee limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be. I understand that a patentee may also define a term during the prosecution of the patent. I understand that the patentee is precluded from recapturing through claim construction specific meanings or claim scope clearly and unambiguously disclaimed or disavowed during prosecution.

32. I understand that extrinsic evidence may also be considered when construing claims in the event that the intrinsic evidence does not establish the meaning of a claim. Extrinsic evidence is any evidence that is extrinsic to the patent itself and its prosecution history. Examples of extrinsic evidence are technical dictionaries, treatises, expert testimony, and inventor testimony. I further understand that extrinsic evidence is generally used to provide background on the technology, explain the invention, ensure the Court's understanding of technical aspects is consistent with a POSA, or to establish the meaning of a particular claim term in a particular field. I understand that extrinsic evidence is less significant than the intrinsic record in determining the meaning of claim language.

V. PERSON OF ORDINARY SKILL IN THE ART

33. I have been asked to investigate, form and offer opinions related to how a POSA would have understood certain terms in the Asserted Patent and how such a person would have understood the disclosures of the Asserted Patent.

34. I have been advised that there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including the educational level of active workers in the field at the time of the alleged invention, the sophistication of the technology, the type of problems encountered in the art, and prior art solutions to those problems.

35. The Asserted Patent relates to float tools configured for use in a casing string for a wellbore. Based on my experience in the industry at the relevant time, it is my opinion that a POSA at the time of the alleged invention is a person with a Bachelor's degree, Master's degree, and/or Ph.D. in Mechanical Engineering or Petroleum Engineering, or at least five years of experience working in horizontal well construction. I am directly familiar with the capabilities of such persons of ordinary skill in the art because I am such a person, and have also worked with such persons.

36. In 2013, I had at least this level of skill in the art, having a Ph.D. in Petroleum Engineering, with about 37 years of engineering experience including 26 years experience with horizontal and highly deviated wellbores. *See* Exhibit 8.

VI. BACKGROUND OF THE TECHNOLOGY

A. Flotation Tools Configured For Use In A Casing String

37. Casing flotation is a well-known technology developed in the late 1980's to extend the lateral reach of a horizontal wellbore. Casing flotation is a well-known, proven technology that has been used for decades to extend the attainable lateral reach of a horizontal or highly deviated wellbore in order to access and produce oil and gas volumes previously unreachable using conventional methods. Exhibit 9 at 1-2; Exhibit 10 at 2:14-3:28. Flotation equipment is generally

unnecessary for vertical wells because the amount of friction that arises from lowering casing vertically into a wellbore can be offset by the weight of the pipe. Flotation equipment is designed to assist in running the casing to the bottom in highly deviated or horizontal wells; subsequent discussions are limited to such applications. In such wells, the casing string can encounter large frictional forces as the string contacts the lower side of the wellbore for great distances. Exhibit 9 at 1-2; Exhibit 10 at 2:14-3:28, FIG. 1. It is well understood that extended-reach drilling employing casing flotation reduces construction costs compared with other methods. Well operators generally consider flotation tools as an integral tool in extended reach well construction. Exhibit 9 at 1-2.

38. Casing flotation overcomes the friction between the wellbore and the casing that causes the casing to become stuck in extended-reach horizontal wells. Exhibit 9 at 1-3. Attempts to run casing in extended-reach horizontal have failed due to friction between the wellbore and the casing, which caused substantial drag. Drag is the difference between the tripping weight and static weight of a drill string or completion assembly. This drag often exceeded the available weight in the vertical section of the wellbore, causing the casing to become stuck. Exhibit 9 at 1-2, 4; Exhibit 10 at 2:14-3:28.

39. Extended-reach drilling with casing flotation is currently the most economical and common approach for building extended reach horizontal wells and is a standard technique used throughout the world. Extended-reach drilling technology employs casing flotation during the completion phase, after the well is drilled to a given distance and it is desired to run pipe, typically to total depth of the drilled wellbore. In some cases, accessing these additional resources cannot be economically justified by any other means than employing casing flotation. Therefore, casing

flotation has become the standard for extended-reach drilling throughout the world. Exhibit 9 at 1-2, 4.

40. Previous attempts to overcome drag associated with extended-reach wells include methods of drilling a well such that the path itself minimizes frictional forces. The catenary drilling method in conjunction with reduced friction-coefficient drilling fluids was developed in the mid-1980's. Exhibit 9 at 1-2. This method modified the wellbore geometry so that the maximum available weight existed in the near- vertical section of the well, while drilling fluids with high lubricity were used to reduce the unwanted drag.

41. Another previous method attempted to overcome the drag forces rather than reduce them by the use of an inverted casing string in which heavy casing was run in the vertical section to provide additional weight. In such applications, if drag forces were high enough, the lower end of the casing could buckle.

42. Another method to overcome drag forces is drilling with casing or drilling with a liner. In such cases, the casing or liner is used in place of drill pipe and left in the hole. Such applications are costly and are applicable under specialized circumstances.

43. Casing flotation uses an air chamber created near the lower end of the casing string, sealed with retrievable plugs that creates a buoyant effect, reducing the casing weight, and resulting in less drag between the casing and the formation. Exhibit 9 at 1-2; Exhibit 10 at 2:14-3:28.

44. Plugs were well-known for use in wellbore operations at the time for a variety of applications, including flotation, production, diversion, cementing, fracturing, etc.

45. In these early casing flotation operations, the buoyant air chamber was created by using retrievable plugs to seal the chamber from the remainder of the casing. Exhibit 9 at 1-2; Exhibit 10 at 2:14-3:28. These retrievable plugs employed in early floating operations needed to be

removed from the casing string after the total casing depth was reached, but before cementing operations were performed. Exhibit 11 at 1:17-2:15.

46. Plugs with rupture discs were eventually used in place of retrievable plugs to seal the chamber, thereby eliminating the costs associated with retrieving the plug. Destructible rupture disc assemblies were designed to rupture when exposed to a predetermined hydraulic pressure when applied from above, thereby avoiding the problems associated with retrieving the retrievable packers. Exhibit 9 at 1-2. But the removal of such rupture discs required wireline retrieval, explosives, milling, spearing, drop bars, or drilling out to open the plug. *See* Exhibit 11 at 1:17-2:15. Plugs that relied on explosives were dangerous and expensive; while plugs that required a wireline run into the casing to install, retrieve, activate, and/or remove the plug were costly and time-consuming. In some cases, plugs created unwanted holes and/or damaged the casing which required a secondary squeeze job of cement and added time and cost to the operation. *See* Exhibit 9 at 2. Additionally, the added time contributed to drilling fluid developing additional gel strength, making it much more difficult to remove the drilling fluid.

47. As tool designers continued to develop improved flotation devices, several important considerations became apparent. Tool internal or inside diameters ("ID") should be increased to allow full casing diameter pathways. Exhibit 9 at 1. Seal configurations should allow for larger tolerances between flotation devices and internal components. The tools needed to be able to hold pressures from both above and below. After casing has been cemented, the internal components of the flotation equipment should be drillable with well-known drilling equipment.

48. When determining whether to use flotation assemblies, operators must take into account: (1) wellbore geometry, (2) friction coefficients, (3) rig equipment, (4) fluid returns, (5) casing collapse ratings, (6) pore pressures and mud weights and (7) geomechanical concerns.

49. Taking into account all of these considerations, it has become apparent that destructible rupture disc assembly plugs are the superior plug to employ in a flotation tool. When casing has reached its desired depth, the destructible assembly plugs may be ruptured using a predetermined hydraulic pressure, thus shattering the assembly allowing the smaller pieces to flush to the surface, thereby avoiding the need to mechanically retrieve any components. Exhibit 9 at 1-2, 4; Exhibit 11 at 1:17-2:15.

50. Destructible rupture disc assembly plugs that restore the full casing diameter after rupturing are preferred as to avoid impeding the fluid production, allowing high rate injections for stimulations, minimizing screenout potential during hydraulic fracturing and allowing a broad range of subsequent workovers and other remedial activities. *See, e.g.*, Exhibit 11 at 2:11-21.

VII. OVERVIEW OF THE ASSERTED PATENT

A. Summary of the Disclosure

51. The ’445 Patent generally discusses a well-known method of using a float tool with a rupture disc assembly to extend the depth of a well. Particularly, a flotation chamber is installed in a casing string. After the desired depth is reached, parts of the float chamber may be ruptured and subsequently removed from the wellbore resulting in full casing ID so that various downhole operations could be readily performed following removal or opening of the buoyant chamber.

52. In operation, a wellbore is drilled into the earth to access underground natural resources such as gas and oil. A casing string, generally made of steel pipe, is lowered into the wellbore and can be cemented into place. The ’445 Patent explains that it is difficult to run a casing string down a horizontal or deviated well because the casing string may drag due to friction between the wellbore and the casing, making it difficult to reach the target zone. Exhibit 2 at 1:22-29.

53. Various techniques to lighten or “float” the casing have been used to overcome the drag (decreasing the friction) and extend the lateral reach of the well. Exhibit 2 at 1:34-35. For

example, the '445 Patent describes plugging the end portion of a casing string and filling it with a low density, miscible fluid to make the end portion of the casing string buoyant and easier to run into the wellbore. Exhibit 2 at 1:35-39. After the casing string is run into the wellbore to the desired depth, the plug must be drilled out. Exhibit 2 at 1:39-46.

54. The '445 Patent explains that the region where the plug is located may have a smaller casing ID than the casing string, which prevents restoring the full casing ID. Exhibit 2 at 1:47-49. According to the '445 Patent, full casing inside diameter is preferred so that there is no need to drill out any part of the device and full production may be achieved.

55. The '445 Patent describes a "float chamber" or a "buoyant chamber" that includes a rupture disc to seal off the buoyant chamber, wherein the rupture disc may be easily removed and results in full casing ID. Exhibit 2 at 1:56-67. Figure 1 of the '445 Patent shows the rupture disc assembly 10 installed in the vertical portion of the wellbore.

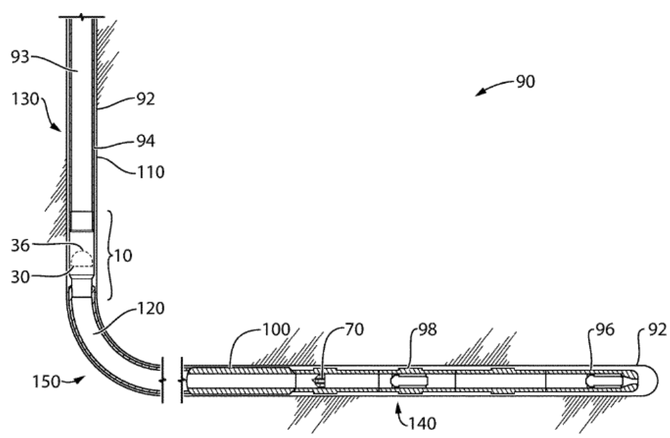


FIG.1

<u>Exhibit 2 at FIG. 1</u>

56. Rupture disc assembly 10 comprises rupture disc 30 which is generally a hemispherical dome, having a convex surface 36 oriented in the uphole direction which is vertical in Figure 1 of the '445 Patent. Exhibit 2 at 4:60-65. Below the rupture disc is a buoyant flotation chamber 120 filled with a gas or liquid. Exhibit 2 at 5:27-48. This buoyant flotation chamber is filled with gas

or liquid having a lower specific gravity than the well fluid in the wellbore. Additionally, other factors such as the well conditions and the amount of buoyancy desired are considered in determining whether to use gas or liquid in the chamber. Exhibit 2 at 5:37-41.

57. According to the '445 Patent, the rupture disc is engaged with the casing string by a securing mechanism. The '445 Patent describes such a mechanism as a shear ring 44, which holds the rupture disc in place as shown in the annotated Figure 2 below. Exhibit 2 at 2:10-11, 8:51-62, FIGs. 2-3.

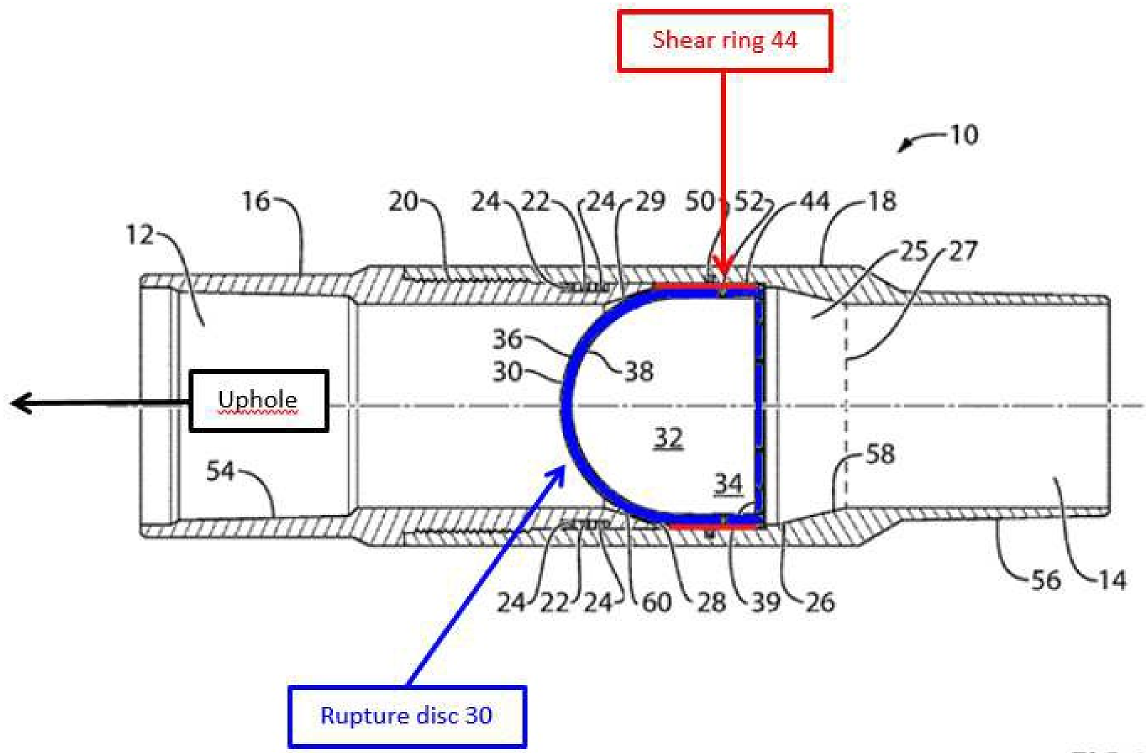


FIG.2

Exhibit 2 at FIG. 2 (annotated)

58. After the casing has been landed, the "rupture disc is then burst by pressuring the casing from the surface." Exhibit 2 at 6:24-26. According to '445 Patent, "[r]upture disc assembly 10 provides a way for a sealed casing string to become unsealed while requiring less hydraulic pressure than prior art rupture disc approaches. This is because a securing mechanism (shear ring

44) allows the rupture disc to be suddenly broken when a pressure is applied to that mechanism. The resulting impact destroys the rupture disc, and allows full casing ID to be restored. Exhibit 2 at 11:27-33; *see also* Exhibit 2 at 11:46-48 ("the impact force on rupture disc 30, combined with the hydraulic pressure, accomplish the breaking of rupture disc.").

59. Specifically, the shear ring shears when a specific hydraulic pressure is applied to it, releasing the rupture disc which then shatters upon impact within the casing string. Exhibit 2 at 2:12-19. The '445 Patent claims that upon impact, the rupture disc breaks into sufficiently small pieces that can be removed by fluid circulation. Exhibit 2 at 2:36-40. Further, full casing ID is restored after the rupture disc is broken because the rupture disc is installed in a widened region of the casing string. Exhibit 2 at 2:40-43, 6:62-7:4.

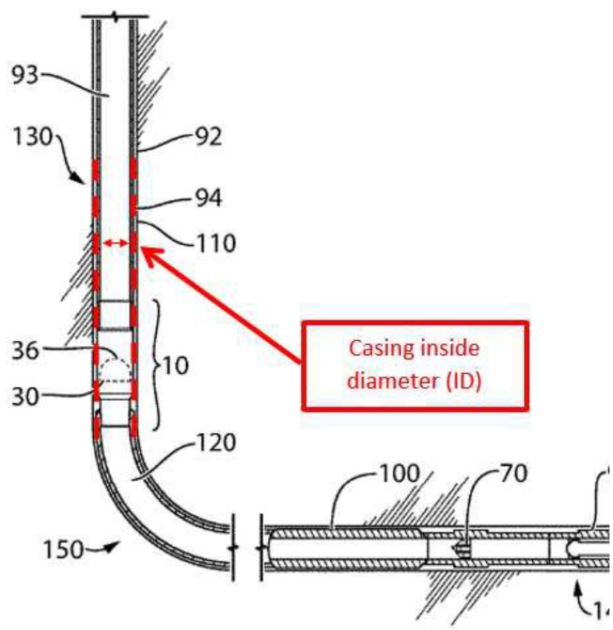


Exhibit 2 at FIG. 1 (annotated)

60. It is my understanding that the Plaintiff has asserted claims 1, 8, 14, 15, 22-25, 27, 28, 29, 36, 37-43, 46, 50-53, and 55-57.

B. Prosecution History

61. I have reviewed the prosecution history of the ’445 Patent and understand that the applicants supposedly distinguished the claims of the application from the prior art by amending the claim language relating to the internal diameter of the casing string.

62. I understand that the applicants argued that the prior art references disclosed rupture disks disposed on seats that restricted the internal diameter of the tubing, such that destroying the rupture disk would not restore the full internal diameter of the casing string. Exhibit 4 at 11-12. I also understand that the applicants argued that the prior art failed to disclose that the rupture disc is in sealing engagement with, and attached to, a region of a tubular member parallel to the internal diameter of the casing string. Exhibit 4 2, 5-6, 9, 11-12. Based on these arguments, I understand that the examiner allowed the claims without further comment. *See* Exhibit 5.

VIII. DISPUTED CLAIM TERMS

A. “internal diameter” (Claims 1, 22, 28, and 50)

Defendant Nine’s Construction	Plaintiff NCS’s Construction
the diameter of a fluid channel measured perpendicularly from the inner wall of the fluid channel through the center of the casing string, to the opposite inner wall	No construction

63. Claim 1 recites:

> 1. A float tool configured for use in a casing string for a wellbore containing a well fluid, **<u>the casing string having an internal diameter</u>** that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:
>
> a rupture disc assembly comprising (i) a tubular member having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in sealing engagement with a region of the tubular member within the upper and lower ends,

> wherein the rupture disc is configured to rupture when exposed to a rupturing force greater than the rupture burst pressure and the region of the tubular member where the rupture disc is attached has a larger internal diameter than **<u>the internal diameter of the casing string</u>** and is parallel to the internal diameter of the casing string.

(emphasis added). Claims 22, 28, and 50 recite the same limitation.

64. It is my opinion that a POSA would understand "internal diameter" based on its plain and ordinary meaning in the art. It is further my opinion that a POSA would understand that the term "internal diameter" is a phrase whose plain and ordinary meaning is merely the product of the ordinary meaning of its components.

65. Here, the term "diameter" has a clear and unambiguous ordinary meaning – "a straight line passing through the center of a circle and meeting the circumference or surface at each end." Exhibit 6, at 341 ("*Diameter*"). When used with the term "internal," this definition is merely modified by specifying that the diameter describes an inner dimension of an object. Indeed, it is my opinion that a POSA would recognize that the term "internal diameter" is often used to describe the diameter of fluid channels through various objects, such as pipes, float tools, or casing strings. Thus, it is my opinion that a POSA would understand "internal diameter" to mean "the diameter of a fluid channel measured perpendicularly from the inner wall of the fluid channel through the center of the casing string, to the opposite inner wall."

66. This construction is fully consistent with the specification of the '445 Patent. The specification describes the internal diameter of the casing string in relation to the constricted opening of the lower tubular member depicted in Figure 2. Exhibit 2 at 7:64-66 ("These other members of the casing string may have an ID similar to the diameter of the constricted opening 27 of lower tubular member 18."). Thus, a POSA would understand, in light of the specification, that the internal diameter of the casing string is similar to the diameter of the constricted opening 27 of

the lower tubular member 18, measured perpendicularly from the inner wall of the fluid channel through the center of the casing string, to the opposite inner wall.

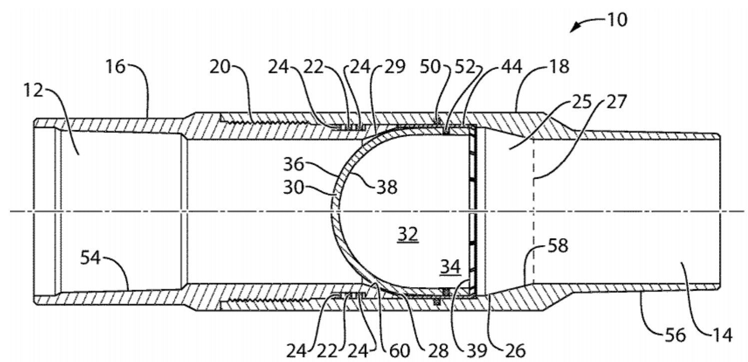


FIG.2

67. Based on the foregoing, it is my opinion that a POSA would understand an "internal diameter" to mean "the diameter of a fluid channel measured perpendicularly from the inner wall of the fluid channel through the center of the casing string, to the opposite inner wall."

B. "tubular member" (Claims 1, 22, 28, and 50)

Defendant Nine's Construction	Plaintiff NCS's Construction
An upper tubular member, and a lower tubular member coupled with the upper tubular member.	No construction.

68. Claim 1 recites:

> 1. A float tool configured for use in a casing string for a wellbore containing a well fluid, the casing string having an internal diameter that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:
>
> a rupture disc assembly comprising (i) **<u>a tubular member</u>** having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in sealing engagement with a region of the tubular member within the upper and lower ends,

> wherein the rupture disc is configured to rupture when exposed to a rupturing force greater than the rupture burst pressure and the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string.

(emphasis added). Claims 22, 28, and 50 all recite the same limitation.

69. It is my opinion that the term "tubular member" does not have a plain and ordinary meaning. While a POSA would be familiar with the term "tubular," this term is not frequently used with "member" in the oil and gas industry.

70. Further, the term "tubular member" has no clear definition in the specification of the '445 Patent. The specification of the '445 Patent never uses the term "tubular member" without qualification. Instead, all 62 uses of the term in the specification of the '445 Patent refer either to the "upper" or "lower" tubular member. Therefore, it is my opinion that a POSA would understand that the specification appears to equate the assembly of the upper and lower tubular members with the claimed tubular member. Accordingly, it is my opinion that a POSA would use the language of the specification, Exhibit 2 at 2:49-54, which exactly parallels the claim structure:

Exhibit 2 at claims 1, 22, 28, and 50	**Exhibit 2 at 2:49-54**
"a rupture disc assembly comprising (i) a **<u>tubular member</u>** having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst in sealing engagement with a region of the **<u>tubular member</u>** within the upper and lower ends."	"the rupture disc assembly comprises **<u>an upper tubular member, and a lower tubular member coupled with the upper tubular member</u>**. The rupture disc is held in sealing engagement between **<u>the upper tubular member and the lower tubular member</u>** by a securing mechanism."

71. It is my opinion that there are no other structures in the specification of the '445 Patent that could arguably equate to a "tubular member." Accordingly, it is my opinion that a POSA, in light

of the specification of the ’445 Patent, would conclude that the “tubular member” is an assembly comprising “an upper tubular member, and a lower tubular member coupled with the upper tubular member.” Exhibit 2 at 2:49-51.

C. “sealing engagement” (Claims 1, 22, 28, 50, and 55)

Defendant Nine’s Construction	Plaintiff NCS’s Construction
attached or secured to create a fluid-tight seal	a substantially fluid-tight seal

72. Claim 1 recites:

> 1. A float tool configured for use in a casing string for a wellbore containing a well fluid, the casing string having an internal diameter that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:
>
> a rupture disc assembly comprising (i) a tubular member having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in **sealing engagement** with a region of the tubular member within the upper and lower ends,
>
> wherein the rupture disc is configured to rupture when exposed to a rupturing force greater than the rupture burst pressure and the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string.

(emphasis added). Claims 22, 28, 50, and 55 all recite the same limitation.

73. It is my opinion that the ordinary meaning of the term “seal” is “to fasten or close tightly by or as if by a seal” or “to close hermetically.” Exhibit 6 at 1105 (“*Seal*”). It is further my opinion that the ordinary meaning of “engage” is to “attach or secure.” Exhibit 6 at 408 (“*Engage*”). It is my opinion that a POSA would combine these two definitions to arrive at “attach or secure to fasten, close tightly, or close hermetically.” Accordingly, it is my opinion that to be in sealing engagement is to attach or secure to fasten, close tightly, or close hermetically.

74. The term “sealing engagement” is used in a similar context in the specification of the ’445 Patent. The specification explains in a preferred embodiment, that a rupture disc in sealing engagement “create[s] a fluid-tight seal.” Exhibit 2 at 9:26-31. This mirrors the plain and ordinary meaning of “seal,” and provides a simpler definition of “sealing” in the context of the ’445 Patent – “creating a fluid-tight seal.” Accordingly, it is my opinion that a POSA would simplify the ordinary meaning of “sealing” to “creating a fluid tight seal,” which is fully consistent with, simplifies, and merely rephrases the ordinary meaning of the term “seal.”

75. After incorporating the simplified meaning of “sealing” in light of the specification, it is my opinion that a POSA would understand “sealing engagement” to mean “attached or secured to create a fluid-tight seal.”

D. “the rupture disc is . . . configured to rupture when exposed to a rupturing force greater than the rupture burst pressure” (Claims 1, 22, 29, and 56)

Defendant Nine’s Construction	Plaintiff NCS’s Construction
Term is indefinite under 35 U.S.C. § 112 Proposed Alternative – the rupture disc will rupture when exposed to a rupturing pressure greater than the rupture burst pressure	the rupture disc can rupture if exposed to hydraulic pressure that is higher than its rupture burst pressure

76. It is my opinion that this claim term is indefinite, because “the rupture disc is . . . configured to rupture when exposed to a rupturing force greater than the rupture burst pressure,” when read in light of the intrinsic evidence, fails to inform with reasonable certainty, those skilled in the art about the scope of the invention.

77. Claim 1 recites:

> 1. A float tool configured for use in a casing string for a wellbore containing a well fluid, the casing string having an internal diameter that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:

> a rupture disc assembly comprising (i) a tubular member having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in sealing engagement with a region of the tubular member within the upper and lower ends,
>
> wherein **the rupture disc is configured to rupture when exposed to a rupturing force greater than the rupture burst pressure** and the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string.

(emphasis added). Claims 22, 29, and 56 all recite the same limitation.

78. It is my opinion that this term is indefinite because it requires a POSA to compare a rupturing force and a rupturing pressure, which are fundamentally not comparable. A POSA would recognize that a force and a pressure are not comparable because they use different units of measurement. In standard units, a pressure is measured in pounds per square inch, while a force is measured in pounds. In metric units, a pressure is measured in Pascals, while force is measured in Newtons. Accordingly, a POSA could not reasonably ascertain when a rupturing force is greater than a rupture burst pressure.

79. Further, it is impossible for a POSA to determine any relationship between a rupturing force and a rupture burst pressure without the claim also delineating the area acted upon. While force is related to pressure by the equation force = (pressure * area), this relationship does not allow a POSA to determine when a force is greater than a pressure any more than it would allow a POSA to determine when a force is greater than an area because any relationship between force and pressure changes substantially depending on area.

80. Looking at the specification of the ’445 Patent results in only further uncertainty as pressure is applied to an area on the top surface of the disc and impact forces are applied to a different area where the disc impacts the tubular. For instance, the specification states hydraulic

pressure can be applied to the top convex surface or a point on the disc. Exhibit 2 at 10:4-5 (pressure applied to "convex surface 36 of rupture disc 30") and 11:63-64 (pressure can cause "point loading" on discs); *see also* Exhibit 13 at 6:25-27 ("pressure may be applied at a central point, a random point or area, or at the perimeter of the plug, or combinations thereof"). Further, the '445 Patent discloses that after the disc is disengaged it moves downward and impacts "various surfaces" on the tubular member to assist in rupturing the disc through impact forces. Exhibit 2 at 2:13-14 and 7:57-58. This impact area is different than the area where pressure is applied on top of the disc. Given that pressure and force are applied to different areas in the specification, any relationship between rupturing force and burst pressure is further removed.

81. For at least these reasons, it is my opinion that the term "the rupture disc is . . . configured to rupture when exposed to a rupturing force greater than the rupture burst pressure" is indefinite.

82. If the term "the rupture disc is . . . configured to rupture when exposed to a rupturing force greater than the rupture burst pressure" is not found indefinite, it is my opinion that a POSA would understand this term to mean "the rupture disc will rupture when exposed to a rupturing pressure greater than the rupture burst pressure."

83. It is my opinion that a POSA may have believed that the claim was intended to compare a rupturing ***pressure*** to a rupture burst pressure, and substitute in "rupturing pressure" for "rupturing force." With that understanding of the term, it is my opinion that a POSA would easily be able to compare a rupturing pressure to a rupture burst pressure. This understanding is supported by the specification, which provides only a single example of a "rupturing force" – "hydraulic fluid under pressure" Exhibit 2 at 2:7-8. However, it is my opinion that a POSA would also discover that in the very next paragraph that "[t]he hydraulic pressure required to cause disruption of the securing mechanism is *less than* the hydraulic pressure that would normally be required to break the rupture

disc." Exhibit 2 at 2:19-21. Thus, assuming that "rupturing force" means "rupturing pressure," such a construction would contradict the specification. Therefore, it is my opinion that a POSA would not be able to understand the scope of the claim with reasonable certainty in light of the specification.

84. Based on the foregoing, it is my opinion that the indefiniteness of this claim cannot be resolved by any reasonable construction.

E. "rupturing force" (Claims 1, 22, 27, 29, 56, and 57)

Defendant Nine's Construction	Plaintiff NCS's Construction
Term is indefinite under 35 U.S.C. § 112 Proposed Alternative – rupturing pressure	a hydraulic pressure or impact force sufficient to rupture the rupture disc

85. It is my opinion that the claim term "rupturing force," when read in light of the intrinsic evidence, fails to inform with reasonable certainty, those skilled in the art about the scope of the invention. For at least the reasons discussed in Section VIII.D, a POSA could not reasonably ascertain how to compare a "rupturing force" to a "rupturing pressure." I understand that claim terms are to be given the same meaning throughout the claims. Accordingly, it is my opinion that "rupturing force" is indefinite.

86. To the extent it is determined that this claim limitation is not indefinite, based on my review of the '445 Patent's claims, specification, and prosecution history, it is my opinion that a POSA would understand "rupturing force" to mean "rupturing pressure." *See* Section VIII.D. It is further my opinion that such a construction would render claims 1, 22, 29, 56, and 57 indefinite. *See* Section VIII.D.

F. "the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string" (Claims 1, 22, 28, and 50)

Defendant Nine's Construction	Plaintiff NCS's Construction
Term is indefinite under 35 U.S.C. § 112 Proposed Alternative – a flat surface of the tubular member where the rupture disc is fastened, affixed, joined, or connected to the tubular member is circular and has a diameter larger than the internal diameter of the casing string, and defines a plane that is parallel to a plane defined by the set of internal diameters at a location in the casing string	In the first portion of the tubular member, the rupture disc is directly secured to and in sealing engagement with a cylindrical surface that is wider than and parallel to the inner surface of the casing string

87. It is my opinion that the claim term "the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string," when read in light of the specification, fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. It is my opinion that this term is indefinite because it requires that two features, an "internal diameter" and a "region," which have no inherent direction to be "parallel." As a result, a POSA could not reasonably understand what is meant by the claim term, or determine if any particular accused product infringes the claim, rendering the claim indefinite.

88. Nonetheless, if forced to find some reasonable construction of this term, it is my opinion that a POSA may attempt to construe the term as "a flat surface of the tubular member where the rupture disc is fastened, affixed, joined, or connected to the tubular member is circular and has a diameter larger than the internal diameter of the casing string, and defines a plane that is parallel to a plane defined by the set of internal diameters at a location in the casing string."

1. "the region of the tubular member where the rupture disc is attached." (the "Attachment Region")

89. Claim 1 recites:

> 1. A float tool configured for use in a casing string for a wellbore containing a well fluid, the casing string having an internal diameter that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:
>
> a rupture disc assembly comprising (i) a tubular member having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in sealing engagement with a region of the tubular member within the upper and lower ends,
>
> wherein the rupture disc is configured to rupture when exposed to a rupturing force greater than the rupture burst pressure and **the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string.**

(emphasis added). Claims 22, 28, and 50 all recite the same limitation.

90. It is my opinion that a POSA would understand that "the region of the tubular member where the rupture disc is attached" refers to a surface of the tubular member where the rupture disc is attached. A POSA would understand that a "tubular member" refers to the assembly of the upper and lower tubular members. *See* Section VIII.B. Further, it is my opinion that a POSA would understand the term "attached" as having its plain and ordinary meaning of "fastened, affixed, joined, or connected." Exhibit 6, at 80 ("*Attach*"). Accordingly, it is my opinion that a POSA would understand "the region of the tubular member where the rupture disc is attached" as "the region of the tubular member where the rupture disc is fastened, affixed, joined, or connected" (the "Attachment Region").

3. "the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string"

91. It is my opinion that a POSA would understand from this term that the Attachment Region must have an internal diameter that is larger than the internal diameter of the casing string. Based on this understanding, it is further my opinion that a POSA would imply that the Attachment Region must be generally circular in order to have a diameter. Accordingly, it is my opinion that a POSA would understand "the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string" to mean "the region of the tubular member where the rupture disc is attached is circular and has a larger internal diameter than the internal diameter of the casing string."

4. The phrase "the region of the tubular member where the rupture disc is attached . . . is parallel to the internal diameter of the casing string" is indefinite.

92. It is my opinion that a POSA would not be able to ascertain with reasonable certainty the meaning of this portion of the claim term in its context, and therefore the term is indefinite. It is my opinion that a POSA would understand that the term "parallel" carries its plain and ordinary meaning, which is "extending in the same direction, equidistant at all points, and never converging or diverging." Exhibit 6 at 892 ("*Parallel*"). A POSA would understand that implicit in this definition is that, for two features to be parallel, they must both have an inherent direction.

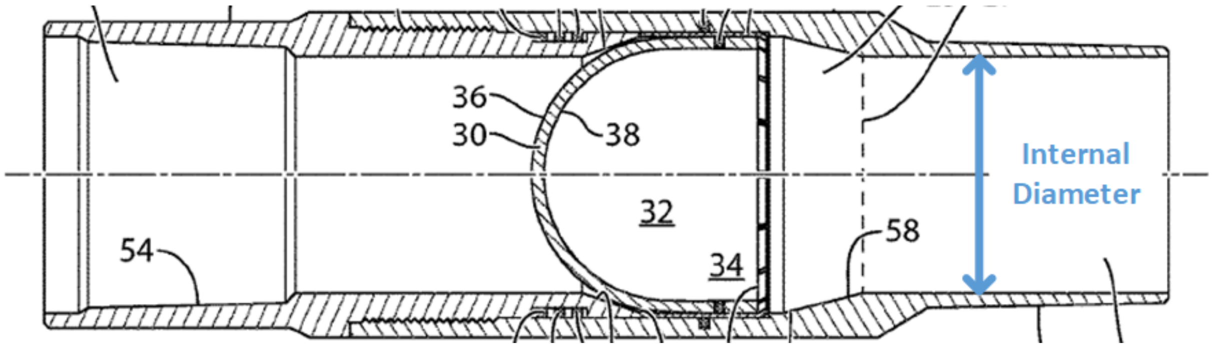
93. A POSA would further understand that an internal diameter of a casing string does not have an inherent direction, and therefore cannot be parallel to another feature. Further, a POSA would understand that an internal diameter is a scalar property of an object with a circular fluid pathway, such as a pipe. *See* Section VIII.A. In other words, an internal diameter is a number, not something with direction. For example, if handed a pipe, a POSA could not point to its internal diameter, but a POSA could measure it. Given an appropriate tool, a POSA could measure the internal diameter

in an infinite number of directions. Thus, it is my opinion that because an internal diameter does not have an inherent direction, a POSA would be unable to determine if another feature was "parallel" to an internal diameter. It is my opinion that because the comparison is impossible, the term is indefinite.

94. Similarly, it is my opinion that the claim language fails to identify any particular direction implied by the Attachment Region. Accordingly, it is my opinion that a POSA would not know how to determine if the Attachment Region was parallel to the internal diameter, which likewise has no inherent direction. For these reasons, it is my opinion that this portion of the claim is indefinite.

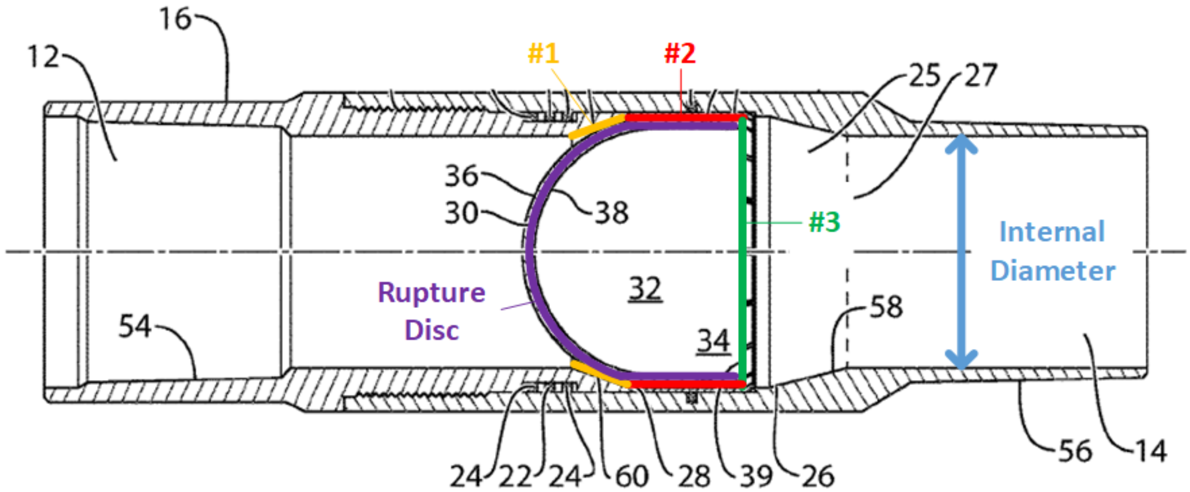
5. If forced to construe "the region of the tubular member where the rupture disc is attached . . . is parallel to the internal diameter of the casing string," it is my opinion that a POSA would arrive at a construction that contradicts the specification.

95. If forced to provide a construction that made sense of this portion of the claim term, it is my opinion that a POSA would reduce the terms "internal diameter of the casing string" and the Attachment Region to geometric concepts that have inherent direction, and thus could be parallel. It is my opinion that one way to do this would be to presume that "parallel to the internal diameter of the casing string" refers to being parallel to a plane defined as a set of measured internal diameters at a location in the casing string. An internal diameter is measured as the distance from one inside wall of a pipe, through the center, to the opposite internal wall at a location in the casing string. *See* Section VII.A. This measurement forms a line segment, an example of which is shown below relative to Figure 2 of the '445 Patent.

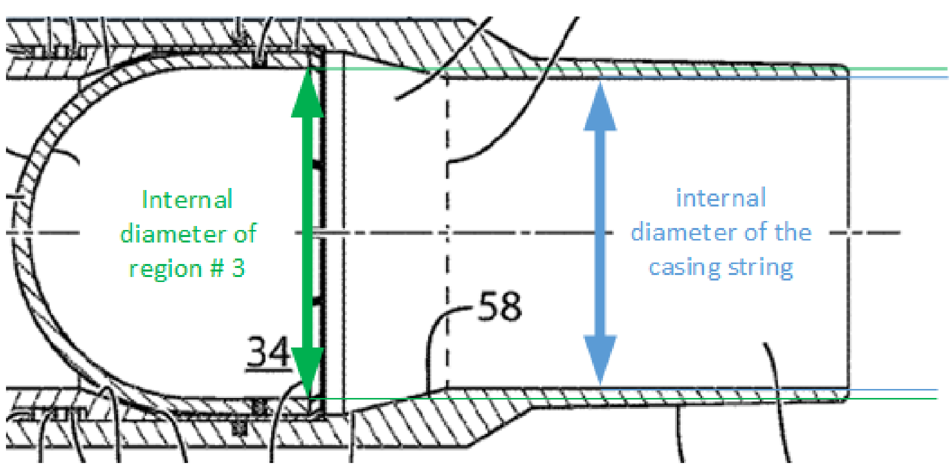


96. While this figure shows the internal diameter in a 2-dimensional cross-section, it is my opinion that a POSA would understand that this represents a potential plane when viewed in three dimensions. In geometric terms, for a given location along the axis of a pipe, any two non-parallel measured internal diameters will be coplanar. Further, all of the measured internal diameters at that axial location will be coplanar. Even more, so long as the casing string is straight, the same procedure could be performed at any axial location to define a plane that is parallel to a plane at any other axial location. As a result, it is my opinion that a POSA could determine that the internal diameter referred to in the claim actually refers to "a plane defined by the set of measured internal diameters at a location in the casing string" (an "Internal Diameter Plane").

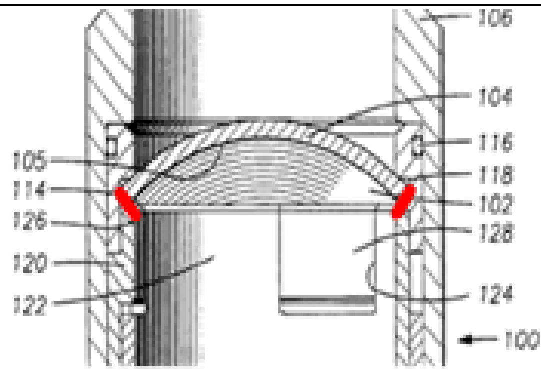
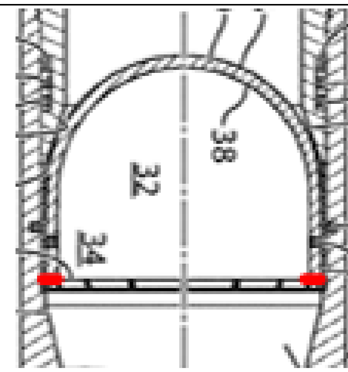
97. Given this understanding of the internal diameter, it is my opinion that a POSA could then look to Figure 2 to see if any potential Attachment Regions are also parallel to this plane. It is my opinion that there are three potential candidate Attachment Regions, where the rupture disc appears to at least be in contact with the rest of the float tool, as shown below:



98. It is my opinion that a POSA would identify attachment region # 3 as such a region that is parallel to the internal diameter of the casing string, because it is generally flat or planar, and is parallel to the Internal Diameter Plane. In contrast, attachment regions #1 and #2 are not planar at all, and thus could not be "parallel," nor are they even shown as parallel on the cross-sectional diagram above. Assuming that region # 3 is correct, it is my opinion that a POSA would assume that an Attachment Region must therefore be flat, and define a plane that is parallel to the Internal Diameter Plane. Further, it is my opinion that a POSA would understand that the rupture disc would sit on the shear ring in Figure 2, having a contact area that was roughly circular – and thus has its own internal diameter, which would be larger than the internal diameter of the casing string, as shown below, and as required by the claim:



99. It is my opinion that this understanding of the term likewise makes sense in view of the prosecution history of the ’445 Patent. In the last response to an office action before allowance, the patentee attempted to distinguish the claims from Figure 3 of *Gano*. Exhibit 4 at 12. Figure 3 of *Gano* is reproduced below next to Figure 2 of the ’445 Patent.

<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Gano (Exhibit 7) at FIG. 3
(excerpted & annotated)</td><td>’445 Patent (Exhibit 2) at FIG. 2
(excerpted & annotated)</td></tr>
</table>

100. The patentee argued that the claims were distinguishable from *Gano* because “Gano’s plug 70 and rupture disc 102 are in sealing engagement with and attached to a region of a tubular member that is not parallel to the internal diameter of the casing string, but is instead sloped.” Exhibit 4 at 12. Here, the only sloped surface is the surface adjacent to the circumferential edge of the rupture disc 102, highlighted in red above. Accordingly, it is my opinion that a POSA would view this statement as confirming that the Attachment Region referred to was the one where the circumferential edge of the rupture disc was resting on the shear ring 44, in region # 3.

101. However, it is my opinion that this alternative construction does not save the claim from indefiniteness. In my opinion, it requires a POSA to infer that “internal diameter” refers to “a plane defined by the set of measured internal diameters at a location in the casing string.” However, it is my opinion that this is not the plain and ordinary meaning of “internal diameter”, nor is this feature described anywhere in the specification, nor is it a common industry understanding of the term. Similarly, it is my opinion that this alternative construction requires

that the Attachment Region necessarily be planar, which is not clearly indicated from the claim language, and requires an inferential leap.

102. It is further my opinion that none of possible Attachment Regions #1-3 satisfy the other requirements of the claim – that the rupture disc be "attached" to the "tubular member." In Figure 2 of the '445 Patent, the rupture disc is depicted as being placed inside shear ring 44. As a result, it only makes contact with the tubular member at shoulder 60. Even that contact, however, is not an "attachment," as required by the claims. Similarly, in both regions #2 and #3, the rupture disc is not even in contact with the tubular member, much less attached to it. Accordingly, it is my opinion that none of the Attachment Regions depicted in Figure 2 satisfy all the elements of this claim term. Accordingly, the entire term "the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string" is indefinite because any potential alternate construction cannot be understood by a POSA with a degree of reasonable certainty.

103. For the foregoing reasons, it is my opinion that this term is indefinite.

G. "specific gravity . . . of the well fluid" (Claims 24 and 52)

Defendant Nine's Construction	Plaintiff NCS's Construction
Term is indefinite under 35 U.S.C. § 112	No Construction

104. It is my opinion that the claim term "specific gravity . . . of the well fluid," when read in light of the specification, fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

105. Claim 24 recites:

> 24. The method recited in claim 23 wherein the first specific gravity is less than a **<u>specific gravity of the well fluid</u>**.

(emphasis added). Claim 52 recites the same claim limitation.

106. Specific gravity is the ratio of the density of a substance to the density of a standard, usually water for a liquid or a solid, and air for a gas (i.e. relative density). A POSA would understand that specific gravity is different for gasses and liquids at standard conditions. A well fluid density is not a constant value across the depth of a well, but varies as a function of both temperature and pressure. As a result, there is no single density value, and thus no relative density value, for the well fluid across the wellbore. Therefore, it is my opinion, in light of the specification and the claims of the '445 Patent, that a POSA could not determine when the first specific gravity or the fluid in the sealed chamber of the flotation column was less than or lower than the specific gravity of the well fluid.

107. For example, as described in W.C. McMordie Jr., et al, *Effect of Temperature and Pressure on the Density of Drilling Fluids*, SPE 11114 (1982) (Exhibit 12), the density of drilling fluids, at temperatures and pressures commonly experienced in wellbores, the density of water and oil-based drilling fluids can vary by 10-14%:

Drilling Fluid	**Table #**	**Min. Density (lb /gal)**	**Max. Density (lb / gal)**	**% Variation**
11 lb/gal Water-Based Drilling Fluid	1	9.59	10.94	14%
14 lb/gal Water-Based Drilling Fluid	2	12.27	13.92	13%
18 lb/gal Water-Based Drlling Fluid	3	16.64	18.35	10%
11 lb/gal Oil-Based Drilling Fluid	4	9.92	11.32	14%
14 lb/gal Oil-Based Drilling Fluid	5	13.09	14.71	12%
18 lb/gal Oil-Based Drilling Fluid	6	16.77	18.46	10%

108. Thus, it is my opinion that claims 24 and 52 are indefinite because a POSA could not determine with reasonable certainty the scope of the invention.

H. "disengage the rupture disc from sealing engagement" (Claim 55)

Defendant Nine's Construction	Plaintiff NCS's Construction
disengage the rupture disc from being attached or secured to create a fluid-tight seal	Before rupturing, move the rupture disc relative to the region

109. Claim 55 recites:

> 55. The method recited in claim 50 further comprising applying a pressure within the casing string greater than the hydraulic pressure in the casing string to **disengage the rupture disc from sealing engagement**.

110. It is my opinion that a POSA would understand "disengage the rupture disc from sealing engagement" based on the ordinary meaning of "disengage" and its understanding of the term "sealing engagement" as previously discussed, *see* Section VIII.C. The ordinary meaning of "disengage" is to release from attachment or connection. Exhibit 6 at 353 ("*Disengage*"). Thus, based on a POSA's understanding of the term "sealing engagement," it is my opinion that a POSA would have understood this term to mean the release of the rupture disc from being attached or connected to create a fluid-tight seal.

I. "rupture disc is configured to disengage from sealing engagement when exposed to a pressure greater than a hydraulic pressure in the casing string" (Claims 28 and 50)

Defendant Nine's Construction	Plaintiff NCS's Construction
Term is indefinite under 35 U.S.C. § 112	the rupture disc, before rupturing, can move relative to the first portion when exposed to a pressure that is greater than a hydrostatic pressure in the casing string (i.e. a disengaging pressure)

111. It is my opinion that the claim term "rupture disc is configured to disengage from sealing engagement when exposed to a pressure greater than a hydraulic pressure in the casing string," when read in light of the intrinsic evidence, is indefinite because it fails to inform with reasonable certainty, those skilled in the art about the scope of the invention.

112. Claim 28 recites:

> 28. A float tool configured for use in positioning a casing string in a wellbore containing a well fluid, the casing string having an internal diameter that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:
>
> a rupture disc assembly comprising (i) a tubular member having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in sealing engagement with a region of the tubular member within the upper and lower ends,
>
> wherein the **rupture disc is configured to disengage from sealing engagement when exposed to a pressure greater than a hydraulic pressure in the casing string** after the casing string has been positioned in the wellbore and the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string.

(emphasis added). Claim 50 recites the same limitation.

113. It is my opinion that a POSA would understand that the ***rupture disc*** – not the rupture disc assembly or any other element – must be configured to disengage from sealing engagement when exposed to a pressure that is greater than the hydraulic pressure in the casing string. However, it is my opinion that a POSA could not reasonably determine how a rupture disc can be configured for the claimed purpose in view of the specification and drawings. It is my opinion that a POSA is left entirely to guess at how such a configuration could be achieved.

114. It is my opinion that a POSA would understand what is meant by "disengage from sealing engagement" and what is meant by "when exposed to a pressure greater than a hydraulic pressure in the casing string." It is my opinion that a POSA would construe the term "disengage from sealing engagement" as "disengage from being attached or connected to create a fluid-tight seal," for substantially the same reasons as discussed in in Section VIII.H. Further, the parties have

agreed, and it is my opinion that a POSA would understand, that the phrase “a pressure . . . greater than a hydraulic pressure in the casing string” refers to an applied pressure that is greater than the hydrostatic pressure in the casing string.” Accordingly, the required configuration means simply that a component is configured to disengage from being attached or secured to create a fluid-tight seal when exposed to a pressure that is greater than the hydrostatic pressure in the casing string.

115. While a POSA would understand these terms, a POSA would not understand how to make a rupture disc so configured. Further, neither the claims nor the specification of the ’445 Patent describes a rupture disc that is configured to disengage from being attached or secured to create a fluid-tight seal when exposed to a pressure that is greater than the hydrostatic pressure in the casing string. Thus, a POSA would not understand how a rupture disc is configured to disengage from being attached or secured to create a fluid-tight seal when exposed to a pressure that is greater than the hydrostatic pressure in the casing string. Accordingly, this term is indefinite.

116. It is my opinion that a POSA might understand that the only means by which a rupture disc could disengage from sealing engagement is by failing when a pressure is applied to the rupture disc. However, it is also my opinion that each and every embodiment in the specification of the ’445 Patent requires that the rupture disc be located in a “securing mechanism” that is configured to disengage from sealing engagement when a pressure is applied to the rupture disc. Exhibit 2 at Abstract, 2:10-11, 2:59-65, 6:28-31, 8:51-65, 9:32-42, 10:22-24. However, it is my opinion that the specification provides no indication that an embodiment without a securing mechanism is contemplated by the inventors. Thus, a POSA would not understand how a rupture disc is configured to disengage from being attached or secured to create a fluid-tight seal when exposed to a pressure that is greater than the hydrostatic pressure in the casing string.

117. For the foregoing reasons, it is my opinion that the term "rupture disc is configured to disengage from sealing engagement when exposed to a pressure greater than a hydraulic pressure in the casing string" is indefinite.

IX. AGREED CLAIM CONSTRUCTIONS

A. "float shoe" (Claims 15 and 43)

118. Claim 15 recites:

> 15. The float tool recited in claim 14 wherein the lower seal is within a float shoe.

(emphasis added). Claim 43 recites the same limitation.

119. The specification of the '445 Patnet states "[r]upture disc assembly 10 forms a temporary isolation barrier, isolating a fluid-filled, upper section of the string 93 from a sealed, buoyant chamber 120 formed in the string between the rupture disc assembly 10 and **a sealing device, such as a float shoe 96 disposed at the lower end of the casing string**." Exhibit 2 at 4:19-24 (emphasis added). Thus, it is my opinion, and the parties have agreed, that a POSA would understand this limitation to mean "a sealing device disposed at the lower end of the casing string."

B. "a pressure greater than a hydraulic pressure in the casing string" (Claims 28, 50 and 55)

120. Claim 28 recites:

> 28. A float tool configured for use in positioning a casing string in a wellbore containing a well fluid, the casing string having an internal diameter that defines a fluid passageway between an upper portion of the casing string and a lower portion of the casing string, the float tool comprising:
>
> a rupture disc assembly comprising (i) a tubular member having an upper end and a lower end, the upper and lower ends configured for connection in-line with the casing string and (ii) a rupture disc having a rupture burst pressure and in sealing engagement with a region of the tubular member within the upper and lower ends,

> wherein the rupture disc is configured to disengage from sealing engagement when exposed to **<u>a pressure greater than a hydraulic pressure in the casing string</u>** after the casing string has been positioned in the wellbore and the region of the tubular member where the rupture disc is attached has a larger internal diameter than the internal diameter of the casing string and is parallel to the internal diameter of the casing string.

(emphasis added). Claims 50 and 55 recite the same limitation.

121. The specification of the '445 Patent makes clear that a pressure greater than the hydrostatic pressure caused by the weight of the well fluid is applied from the surface to rupture the rupture disc. *See, e.g.*, Exhibit 2 at 6:24-28 ("Once the casing has run and landed, circulating equipment may be installed. The rupture disc is then burst by pressuring the casing from surface. To accomplish this, fluid pressure (e.g., from the surface) is applied through the casing string 94."); *id.* at 11:8-10 ("Rupture disc 30 may be calibrated to rupture at a predetermined pressure in response to a pressure differential when high pressure is applied to the convex surface 36 of disc 30."); *id.* at 13:5-8 ("Referring back to FIG. 1, in a method of using the rupture disc assembly in a float tool, once the float tool is run into the desired depth as described above, sufficient hydraulic pressure is applied."); *id.* at 13:60-62 ("Once the casing is ran, circulating equipment may be installed. The rupture disc assembly is ruptured by pressurizing the casing."). Thus, it is my opinion, and the parties have agreed, that a POSA would understand the term "a pressure greater than a hydraulic pressure in the casing string" to mean "an applied pressure that is greater than the hydrostatic pressure in the casing string."

C. "a portion of the sealed chamber is buoyant in the well fluid" (Claim 46)

122. Claim 46 recites:

> 46. The float tool recited in claim 36 wherein the sealed chamber is sized such that **<u>a portion of the sealed chamber is buoyant in the well fluid</u>**.

(emphasis added).

123. The ’445 Patent states “[t]echniques to lighten or ‘float’ the casing have been used to extend the depth of well. For example, there exists techniques in which the ends of a casing string portion are plugged, the plugged portion is filled with a low density, miscible fluid to provide a **buoyant force**.” Exhibit 2 at 1:34-39 (emphasis added). It is my opinion that the buoyant force on an immersed object is equal to the weight of the fluid displaced by the object. As the specification notes, buoyant forces can be used to “float” casing. Thus, it is my opinion, and the parties have agreed, that a POSA would understand the term “a portion of the sealed chamber is buoyant in the well fluid” to mean “the density of a portion of the sealed chamber is lower than that of the surrounding wellbore fluid.”

I declare under penalty of perjury that the following is true and correct.

Executed in Houston, TX, USA

By: DNathan Meehan

D. Nathan Meehan, Ph.D., P.E.

Date: Oct. 30, 2020

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